



WHITEPAPER

THE URGENT CASE FOR PLASTIC TRACEABILITY AND SMARTER RECYCLING

JUNE 2025

A large pile of plastic waste, including bags and fragments, filling the frame. The plastic is mostly clear and translucent, with some pieces in blue, green, and red. The waste is piled high, creating a dense, textured surface. The lighting is somewhat dim, highlighting the various shapes and sizes of the plastic debris.

**THIS ISN'T WASTE.
IT'S A VALUABLE RESOURCE.**



This whitepaper was created by Polytag in June 2025 to drive urgent action and innovation in plastic recycling. It reflects Polytag's commitment to building a transparent, data-driven circular economy through collaboration, technology, and traceability.

For more information, case studies, and partnership opportunities, visit www.polytag.io

THE CIRCULAR ECONOMY
ISN'T A DISTANT AMBITION.
IT'S A SYSTEM WE'RE
ALREADY BUILDING.
**NOW WE NEED TO MAKE IT
WORK AT SCALE.**

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FOREWORD

ALICE RACKLEY
CEO AND CO-FOUNDER
POLYTAG

**POLYTAG IS AMONG
THE VERY FEW
BUSINESSES THAT
HAVE DESIGNED,
BUILT AND DELIVERED
A SCALED SOLUTION
TO TACKLE THE
PLASTICS CRISIS**

The UK's plastics recycling system is at a tipping point.

It's no secret the current system is falling short. Most of our plastic ends up downcycled, burned, buried or shipped out of the country. But while the plastic crisis is real, so is the progress.

Innovation is scaling. Partnerships are forming. We finally have the tools to make a real difference.

The circular economy isn't a distant ambition. It's a system we're already starting to build. Now we need to make it work at scale, create alignment across the value chain and ensure it delivers commercially as well as environmentally.

Although there is a growing awareness of the scale of the plastics crisis - and plenty of data to prove that we are living through one - Polytag is among the very few businesses that have designed, built and delivered a scaled solution that has a tangible impact and delivers answers with a commercial value.

At Polytag, we're here to build, fix and deliver. The industry doesn't need more noise. It needs real, proven solutions and someone to build the circular economy for single-use plastics.



Not just another organisation publishing a report about the stagnant recycling rates in the UK, and taking no action.

The good news is that while everyone else is still talking about the problem of plastics, we've been busy solving it and building the solution.

We understand the plastics value chain from end-to-end, and we've developed a scalable, commercially viable solution that is already transforming how plastic packaging is detected, sorted and recycled. Not in theory, but in practice. Right now.

Thanks to Polytag's technology, brands and recyclers can unlock real, measurable data about the movement of their plastics. We're talking barcode-level data. Food-grade sorting. Closed-loop recycling. The action that turns "recyclable plastic" from a marketing buzzword into a genuine, functioning system.

Why are we doing this? Because until we are able to ensure plastic packaging is detected, sorted and recycled back into the same grade it started as, we're not recycling, we're downcycling. Worse

still, we could be burning it, burying it or exporting it to another nation entirely. That's not going to help achieve our circular ambitions.

We have the tech, and we have found the right partners and brands to join us on our mission to optimise and incentivise recycling of single-use plastic. But most importantly, we have the proof that plastic can be detected, sorted and recycled in a way that protects its value.

This is a challenge for the whole system, but also a massive opportunity. One we can meet with collaboration, courage and real commitment.

So here it is. Our blueprint for change.

Stop hiding behind complexity.

Stop waiting for someone else to lead.

Start backing real, tried and tested solutions.

Because the circular economy won't build itself. We've started, and we're inviting the whole industry to build it with us.



THE PROBLEM

Despite the many awareness programmes that have highlighted the environmental impact of plastic waste, the UK's recycling system continues to fall short. At the core of its failure is a lack of traceability and our inability to track plastic packaging from production through to its end-of-life.

This undermines recycling efficiency, policy compliance and the credibility of sustainability claims made by businesses large and small.



PROBLEM 01:
WE HAVE A SYSTEM BUILT ON GUESSWORK

MORE OFTEN THAN NOT, VALUABLE PLASTIC IS DOWNCYCLED INTO LOWER-GRADE MATERIALS, OR WORSE, INCINERATED OR EXPORTED.

Today, most brands and retailers are in the dark when it comes to the destination of their packaging. While many claim their products are "recyclable", the reality is that without item-level traceability, these claims are impossible to verify. The infrastructure to detect, sort and track plastic packaging, by material type, food-grade status or brand ownership, is the dream.

The result of this challenge is that, more often than not, valuable plastic is being downcycled into lower-grade materials, or worse, incinerated or exported. And that means that we have a recycling system that is inefficient and increasingly misaligned with both environmental goals and regulatory expectations.

PROBLEM 02:
POOR DATA IS HOLDING US BACK

A LACK OF ACCURATE DATA MAKES IT DIFFICULT TO REWARD GOOD PRACTICE OR PENALISE POOR PERFORMANCE.

With the introduction of Extended Producer Responsibility (EPR) and the Plastic Packaging Tax, as well as ongoing changes to Recyclability Assessment Methodology (RAM), brands face mounting pressure to demonstrate compliance and improve recycling outcomes.

However, at present, they can't access accurate, real-time data, so compliance becomes a guessing game. Brands are left relying on estimates, while local authorities and recyclers struggle to meet their targets. A lack of accurate data also makes it difficult to reward good practice or penalise poor performance.

And it's not only that. Without clear, verified evidence that closed-loop recycling is taking place, the demand for high-quality recycled plastic remains limited. This uncertainty makes it difficult for businesses and investors to justify the costs of developing more advanced recycling infrastructure.

As a result, progress toward a more circular economy is slowed, and valuable materials continue to be lost to landfills or downcycled into lower-value products.

PROBLEM 03: **A LACK OF CONSISTENCY**

SORTING TECHNOLOGIES ARE INCONSISTENT

The UK's recycling system is fragmented and collection schemes vary by region. On top of that, sorting technologies are inconsistent and data sharing across the packaging value chain is not a focus for businesses. This makes it practically impossible to build a national picture of plastic flows, let alone optimise them.

PROBLEM 04: **WE ARE NOT ON THE FRONT FOOT**

HIGH VOLUMES OF POTENTIALLY RECYCLABLE PLASTIC ARE BEING CONTAMINATED OR MISCLASSIFIED AND END UP BEING DOWNCYCLED, EXPORTED OR LANDFILLED

What is clear, is that the UK's recycling system operates in a reactive, rather than proactive, way. It focuses on managing waste after it's been discarded, rather than designing packaging and supply chains that support circularity from the outset.

And it's this mindset that is impacting sorting efficiency – one of the most critical steps in the recycling process. When packaging is not designed with recyclability in mind, even the most advanced sorting technologies struggle to correctly identify and separate materials. As a result, high volumes of potentially recyclable plastic become contaminated or misclassified and end up being downcycled, exported or landfilled.

Inconsistent and increasingly complex feedstock has made sorting accuracy more challenging, while a lack of standardised data and traceability across the value chain means it's often unclear what happens to packaging once it enters the system.

For recyclers, this makes it harder to operate efficiently, while there is less impetus to invest in upgraded technologies, as they can't reliably predict the type or quality of material they'll receive. At the same time, brands are discouraged from specifying recycled content in their products, since supply cannot meet the necessary standards for quality, consistency or traceability.

Without a fundamental shift toward a more proactive, design-led approach, the UK will likely remain locked in a cycle of underperformance, where inefficiencies across the value chain hinder innovation and progress toward circularity.

THE FUTURE

Let us be clear. The path to a circular plastics economy shouldn't be trodden in isolation. However, it does require someone to forge the route and take the lead. And then it requires coordinated action across the entire value chain, from packaging designers and brand owners to recyclers, regulators and technology providers.

Collaboration should no longer be seen as a 'nice to have'. It's a strategic imperative.



"THE SCALE OF THE PLASTICS CHALLENGE DEMANDS COLLECTIVE INTELLIGENCE AND SHARED RESPONSIBILITY.

"IT'S THROUGH COLLABORATION THAT WE WILL ACHIEVE THE SHARED GOALS OF IMPROVING RECYCLABILITY AND ENSURING RESOURCES ARE USED EFFICIENTLY AND EFFECTIVELY. IT'S IMPERATIVE THAT BUSINESSES ACROSS THE PACKAGING INDUSTRY **WORK TOGETHER SO WE CAN EFFECT REAL CHANGE IN THE UK'S RECYCLING INDUSTRY."**

KAREN GRAYLEY
HEAD OF THE PRODUCER RESPONSIBILITY ORGANISATION (PRO) FOR EXTENDED PRODUCER RESPONSIBILITY FOR PACKAGING (PEPR)



**BY COMBINING
UV WATERMARKS
WITH WORLD
LEADING SORTATION
TECHNOLOGY, WE HAVE
ACHIEVED A MILESTONE
MOMENT IN THE
RECYCLING INDUSTRY**

COLLABORATION IS THE KEY

At Polytag, we've decided that we need to drive change in the recycling sector.

So, we have begun identifying and working with leading European partners that will help us build a future-proof solution for the industry. One that is scalable and commercially viable. That delivers barcode-level traceability. And can enable recyclers to sort by any means necessary, be it food grade, polymer type or even brand ownership. Through collaborations, we will bring data that delivers real impact.

Recently, we announced our partnership with Pellenc ST. By combining our UV watermarks with world leading sortation technology, we have achieved a milestone moment in the recycling industry, which will mark the end of downcycling and the start of optimised and value-driven plastics recycling.

The integration of Polytag UV watermark technology – based on GS1 open standard

data matrices – with Pellenc ST's advanced sortation systems, will enable real-time tracking and optimisation of packaging waste through the recycling process from materials recovery facility (MRF) to recyclers.

This means that detection units within a MRF can capture associated data from every UV watermarked item that enters a facility, providing recycling facilities with new capabilities to detect and sort waste streams. Ultimately, by embedding smart data at barcode level directly into packaging materials, we are empowering waste management companies and brand owners with 'unprecedented' control of the recycling journey of their products.

This isn't a pilot project – it's real proof that collaboration will drive the change needed in our recycling system. And it shows that when stakeholders align around open standards, shared data, and common goals, the results can be transformational.

MOVING FROM GUESSING TO KNOWING

For too long, the recycling industry has operated on assumptions. Brands have had to guess where their packaging ends up, and recyclers have lacked visibility of material flows. Not only that, but regulators have also struggled to enforce policies without reliable data.

This era needs to end.

Polytag's UV watermark technology, which has been validated through extensive, independent testing by Citeo, has opened the door to achieving real-time, barcode-level tracking of plastic packaging through the recycling process.

This accurate data is giving brands unprecedented insight into where, when and how their materials are collected and processed. It's a game-changer for procurement teams negotiating rPET and rHDPE supply contracts, and – we believe – will be a critical tool for improving RAM ratings.

With this level of transparency and traceability, FMCG brand owners will be able to move from vague sustainability claims to evidence-based reporting.



**ACCURATE DATA
WILL GIVE BRANDS
UNPRECEDENTED
INSIGHT INTO
WHERE, WHEN
AND HOW THEIR
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"ACCESS TO **VERIFIED RECYCLING DATA** IS NO LONGER A LUXURY, IT'S A NECESSITY. TECHNOLOGICAL ADVANCEMENTS OPEN UP OPPORTUNITIES FOR MUCH-NEEDED IMPROVEMENTS IN OUR RECYCLING SYSTEM.

"POLYTAG'S TECHNOLOGY AND VISION HIGHLIGHT **A CLEAR BUSINESS CASE FOR INVESTING IN MRFS TO EMPOWER BRANDS** TO MAKE INFORMED DECISIONS, MEET COMPLIANCE REQUIREMENTS, AND BUILD TRUST WITH CONSUMERS AND REGULATORS ALIKE."

JESSICA BARTON
HEAD OF ADVISORY SERVICES
ECOSURETY



NEXT GENERATION SORTATION

Advanced sortation is the linchpin of a high-functioning recycling system. Without it, even the best packaging design and collection schemes will fall short. That's why our partnership with Pellenc ST is so significant.

By combining near-infrared (NIR) spectroscopy with our UV watermarks, Pellenc ST's systems can now sort packaging not just by polymer type, but by food-grade status, material type and even brand ownership. This level of precision opens the door to true closed-loop recycling and will reduce downcycling of plastics.

UV detection technology is proven, with 100% of tagged single-use plastic bottles tracked and traced by Citeo at one of France's busiest MRFs. Polytag's detection units are already in play at MRFs around the UK, and by integrating with Pellenc ST's systems, we are already in a position to redefine the future of sortation.

**"OPEN STANDARDS
ARE CRITICAL TO
IMPLEMENTING DIGITAL
PRODUCT PASSPORTS.
OUR COLLABORATION
WITH POLYTAG EQUIPS
RECYCLING FACILITIES
WITH THE TOOLS THEY
NEED TO OPTIMISE
MATERIAL RECOVERY AND
SUPPORT THE TRANSITION
TO A CIRCULAR ECONOMY."**

JEAN HENIN
CEO
PELLENC ST



HOW DO WE GET THERE?

PART 01: **PRIORITISE TRACEABILITY**

For businesses, the first step is to stop thinking that estimates are enough, and to demand real data. It's achievable today by integrating UV watermarks into packaging processes. We have proven time and time again that an affordable, low-disruption change will unlock real-time, barcode-level insights. This data will deliver accurate reporting, while supporting compliance with EPR, and strengthening procurement negotiations for recycled materials like rPET and rHDPE.

Regulators, meanwhile, must accelerate the adoption of open standards and digital product passports. We believe that mandating traceability at item level will drive consistency across the sector and ensure that sustainability claims are backed by evidence, not guess work.

**DATA WILL DELIVER
ACCURATE
REPORTING, WHILE
SUPPORTING
COMPLIANCE
WITH EPR, AND
STRENGTHENING
PROCUREMENT
NEGOTIATIONS**

PART 02: **BUILD COLLABORATIVE INFRASTRUCTURE**

Despite their best interests, no single business can solve this alone. Industry leaders must work together to co-invest in detection infrastructure, sharing data and aligning on best practices. Programmes like Ecotrace are already proving that collaboration works, bringing together retailers, recyclers and technology providers to deliver measurable results.

Our partnerships with Pellenc ST and Citeo show what's possible when innovation is shared. These models should be replicated and scaled across the UK and beyond.

**WE MUST WORK
TOGETHER TO
CO-INVEST IN
DETECTION
INFRASTRUCTURE,
SHARING DATA AND
ALIGNING ON BEST
PRACTICES**

PART 03: **COMMIT TO CONTINUOUS INNOVATION**

The plastics crisis is evolving, and so must our response. Brands and regulators must embed innovation into their long-term strategies, ensuring that recycling systems remain adaptive, data-driven, and fit for purpose.

**BRANDS MUST
EMBED INNOVATION
INTO THEIR LONG-
TERM STRATEGIES**



PART 04: **INVESTMENT IN RECYCLING SYSTEMS**

THE TOOLS TO TRANSFORM PLASTIC RECYCLING EXIST TODAY

It's clear - the tools to transform plastic recycling now exist. What's needed now is coordinated and decisive action from across the value chain.

At Polytag, we are moving on from pilot projects to delivering real change on a national scale, embedding traceability, transparency and technology into the heart of a modern recycling system that can take the country closer to a 100% rate.

PART 05: **EMBRACE NEXT-GEN SORTATION**

TECHNOLOGIES THAT ENABLE PRECISE SORTING BY POLYMER TYPE, FOOD-GRADE STATUS AND EVEN BRAND OWNERSHIP SHOULD BE A PRIORITY

Recycling outcomes are only as good as the systems that sort the material. Advanced sorting, combining NIR spectroscopy with UV watermark detection, should be a top priority for MRFs and local authorities.

These technologies enable precise sorting by polymer type, food-grade status and even brand ownership, dramatically improving material recovery and reducing contamination. This is not future tech, it's ready now.

**YOU CAN BE MEASURING
RECYCLING AT SCALE
IN SECONDS,
TODAY**

THE ANSWER

The opportunity is here. The technology is proven. The partnerships are in place. Now it's time to act by joining the Ecotrace end-to-end lifecycle UV tag-and-trace programme.

INTRODUCING YOU TO ECOTRACE

This industry-led programme will unlock a real-time data revolution. Data is the key enabler for a successful circular economy and will inform strategy at both a brand-level and a national-level.



Brand supporters of the Ecotrace programme each make a £100,000 contribution to pay for the costs of developing and installing detection units in UK recycling centres. We have already begun working with M&S, Waitrose & Partners and Ocado Retail.

Through the Ecotrace programme, we have already installed a network of UV watermark detection equipment installed across the UK's 12 largest recycling centres – including those run by Biffa, N+P, Re-Gen, Suez, Sherbourne, Pearce and Welsh councils. This has secured 50% coverage of the total domestic recycling throughput (based on the Monksleigh Report), but we have our sight set on being deployed in 40+ UK sites that will take us to over 90% coverage.

In addition to playing their part in catalysing this ground-breaking detection network, the brand supporters of the Polytag Ecotrace Programme also receive 12-months free access to the Polytag dashboard to view their detected packaging at barcode-level.

JOIN THE ECOTRACE PROGRAMME BEFORE SEPTEMBER AND BE PART OF THE SOLUTION.

LET'S STOP TALKING ABOUT CIRCULARITY, AND START BUILDING IT!

ECOTRACE PARTNERS



M&S

Ocado

WAITROSE
& PARTNERS

Biffa

Re-Gen
Waste

N+P



SHERBOURNE
RECYCLING

Pearce
Recycling

SUEZ

CASE STUDY

The economic pitfall of plastic recycling

OVERVIEW

Plastic recycling is often promoted as a sustainable solution to plastic waste. However, the economics behind it tell a different story, especially when it comes to high-performance plastics used in consumer packaging.

THE VALUE GAP

Consider a master-batch coloured performance plastic bottle used to sell shampoo. As a virgin material, it costs around £1,500 per tonne. Yet, after just one use and processing through a recycling centre, its value plummets to £150 per tonne. This represents a 90% loss in value, a catastrophic depreciation for a resource that has only served a single lifecycle.

WHY THE LOSS?

The primary culprit is downcycling. Instead of being reused for the same high-quality application, the recycled plastic is often turned into lower-grade products like textiles, packaging fillers, or construction materials. These uses don't require the same performance characteristics, and thus, the material's original value is lost.

THE CALL TO ACTION

To reverse this trend, we must shift towards genuine bottle-to-bottle recycling. This means designing systems and materials that allow used bottles to be recycled back into new bottles of equivalent quality. Doing so would:

- Preserve material value
- Reduce demand for virgin plastic
- Make recycling commercially viable

CONCLUSION

Without a fundamental change in how we recycle plastics - especially high-performance packaging - we risk continuing a cycle of waste and economic inefficiency. True circularity lies in retaining value, not just reprocessing material.

THERE MUST BE A SHIFT TOWARDS GENUINE BOTTLE-TO-BOTTLE RECYCLING. THIS MEANS DESIGNING SYSTEMS AND MATERIALS THAT ALLOW USED BOTTLES TO BE RECYCLED BACK INTO NEW BOTTLES OF EQUIVALENT QUALITY.

A large pile of sorted plastic waste, including green and blue bottles, ready for recycling. The waste is organized into distinct layers of color, with green bottles on top, blue bottles in the middle, and brown bottles at the bottom. The bottles are tightly packed and appear to be part of a large-scale recycling operation.

THE SOLUTION TO
TRANSFORM RECYCLING
IS HERE.

NOW IS YOUR CHANCE TO
DRIVE THE CHANGE OUR
PLANET REQUIRES.

LET'S SOLVE THE PROBLEM TOGETHER



GET IN TOUCH

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